



Briefing : Benzene in Petrol

- Since 1990 ambient benzene levels have been falling and the majority of air quality monitoring sites in the UK now record levels lower than 1 part per billion.
- The UK ambient air quality standard for benzene is 5 parts per billion (ppb) as a rolling annual average to be achieved by 2005. This will be tightened to 1.5 ppb or less in 2011.
- The switch to unleaded petrol in the UK enabled catalytic converters to be fitted to petrol driven cars. Catalytic converters halved benzene emissions from cars between 1990 and 2000 and are predicted to halve them again by 2010.
- The maximum benzene content of petrol was reduced to 1% by volume in 2000, which further reduced both emissions and ambient concentrations of benzene.

Background.

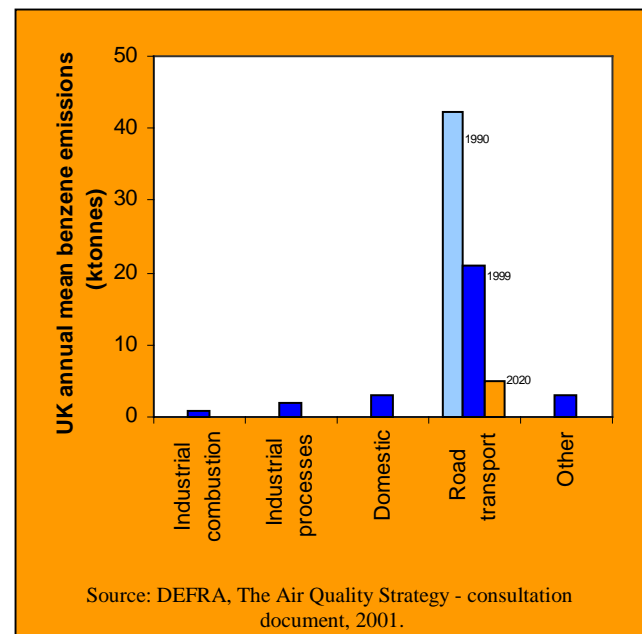
Benzene is an aromatic hydrocarbon that occurs naturally in crude oil and hence in the petrol derived from it. Additional benzene is formed in the refining process; however, since 2000 the level of benzene in petrol has been limited to a maximum of 1% by volume. Benzene is also produced during the combustion of petrol in vehicle engines.

There are no well-defined natural sources of atmospheric benzene in the UK; hence the observed levels are due to human activity, in particular the use of petrol in vehicles as illustrated in figure 1. Benzene is an industrially important chemical feedstock with wide ranging uses including the manufacture of plastics, nylon and pharmaceuticals.

Air Quality Standard.

Benzene is a carcinogen and occupational exposure to very high concentrations has been linked to an increased risk of developing acute myeloid leukaemia. As a result the UK Government has adopted the Expert Panel on Air Quality Standards recommendation of an annual average limit for benzene of 5 ppb, to be achieved by 2004. This will be revised to 1.5 ppb in England and Wales by 2011 and to 1 ppb in Scotland.

Fig. 1. UK sources of benzene emissions



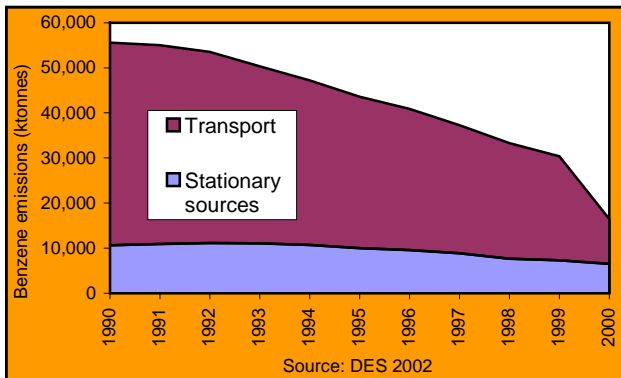
In 1994 the Expert Panel on Air Quality Standards also stated that the "current average concentrations of benzene to which the general public are exposed in the UK's air present an exceedingly small risk to health".

Forecast reductions in atmospheric benzene concentrations will reduce this exceedingly small health risk still further. The European Union Air Quality Daughter Directive target for 2010 is 1.5 ppb.

Benzene Reduction Technology.

Emissions of benzene have reduced dramatically over the last decade (figure 3).

Fig. 2. Total UK benzene emissions

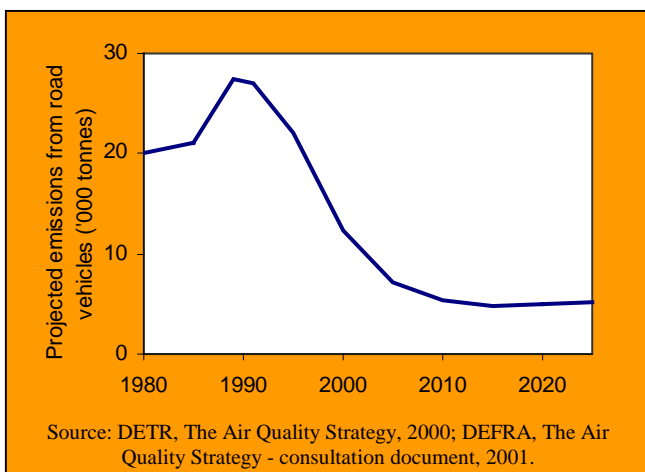


The oil industry, along with the motor industry, is continuing to work to minimize the main mechanisms by which benzene in petrol may enter the atmosphere. These are shown below in order of their effectiveness.

Mechanism	Control methods
1. Exhaust tailpipe emissions.	Improved catalytic converters (enabled by unleaded petrol).
2. Petrol evaporation from fuel system when stationary.	Carbon canisters on cars trap hydrocarbons including benzene.
3. Vapour release during delivery and storage of petrol.	Vapour recovery on petrol deliveries due to be completed by 2004.
4. Vapour release when filling vehicle petrol tank.	Forecourt vapour recovery, legislation expected in 2003.

On top of the above control methods the volatility and the benzene content of petrol have also been reduced.

Fig. 3. UK urban road benzene emissions

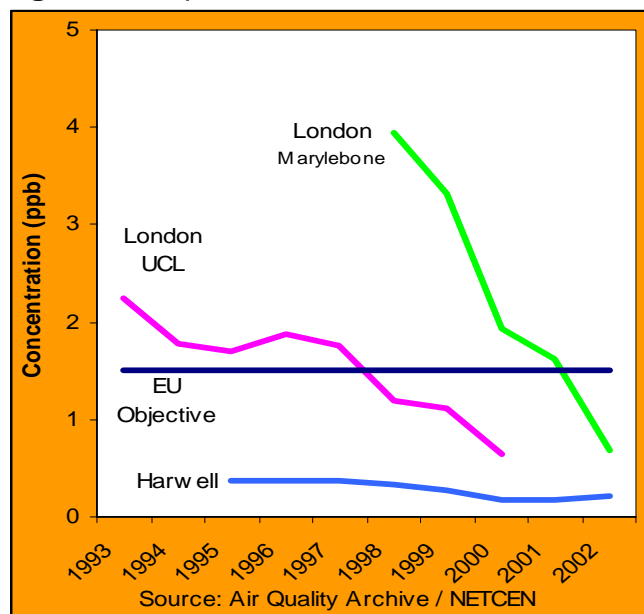


The reduction in benzene content of petrol was required by the European Union Directive 98/70/EC, which reduced the maximum amount of benzene permitted in petrol from 5% to 1% on 1st January 2000. The current average benzene content for petrol sold in the UK is around 0.7%.

Air Quality.

Air quality has shown dramatic improvements since the early 90s, with significantly lowered ambient benzene concentrations (see figure 2). The proposed EU target of 1.5 ppb is already being met in most urban and rural background locations monitored in the UK. Even at some busy roadside locations, for example Marylebone Road in London, 2002 benzene levels were only about 0.7 ppb.

Fig 2. Atmospheric benzene levels.



All levels are expected to drop over the next few years to below the future English target of 1.5 ppb.

Conclusions.

Over the past decade the benzene emission targets recommended by the UK Governments Expert Panel on Air Quality Standards have been widely met. Since 1990 the emissions of benzene from motor vehicles have halved and are predicted to halve again over the next decade. The oil and motor industries are both contributing to this reduction, which will help to ensure that the future target for benzene concentrations will be met.